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TITLE: IN-VEHICLE AUTOMATED CALL
ROUTING USING AN ORIGIN
IDENTIFIER

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IN-VEHICLE AUTOMATED CALL ROUTING USING AN ORIGIN IDENTIFIER

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FIELD OF THE INVENTION

This invention relates generally to wireless communications with a mobile vehicle. More specifically, the invention relates to a method and system for
10 implementing automated call routing using an origin identifier within a telematics equipped mobile vehicle.

BACKGROUND OF THE INVENTION

The opportunity to utilize wireless features in a mobile vehicle is ever
15 increasing as the automobile is being transformed into a communications and entertainment platform as well as a transportation platform. Wireless features include wireless vehicle communication, networking, maintenance and diagnostic services for a mobile vehicle.

Typically, conventional wireless systems within mobile vehicles (e.g.
20 telematics units) answer all incoming call signals. This occurs whether the vehicle is running or simply "awake" because of a programmed cycle. While this behavior has not been overly problematic in the recent past, it has in fact been necessary to ensure that data connectivity to the telematics unit is possible at all times. However, problems may occur in the implementation of new features,
25 such as, for example Enhanced Call Forwarding.

Unfortunately, after a call has been answered by the telematics unit it can not be forwarded to voice-mail without employing a network-based solution, which has been shown to be costly and quite complex. It would be desirable, therefore, to provide a method and system that would overcome these and other
30 disadvantages.

SUMMARY OF THE INVENTION

One aspect of the invention includes a method for operating a telematics unit within a mobile vehicle. The method includes receiving an incoming call signal including an origin identifier, determining an answer mode based on the origin identifier of the incoming call signal, initiating the answer mode responsive to the answer mode determination, and operating the telematics unit based on the initiated answer mode.

In accordance with another aspect of the invention, a computer readable medium storing a computer program includes: computer readable code for determining an answer mode based on an origin identifier included within an incoming call signal; computer readable code for initiating the answer mode responsive to the answer mode determination; and computer readable code for operating the telematics unit based on the initiated answer mode.

In accordance with yet another aspect of the invention, a system for operating a telematics unit within a mobile vehicle is provided. The system includes means for receiving an incoming call signal including an origin identifier. The system additionally includes means for determining an answer mode based on the origin identifier of the incoming call signal. Means for initiating the answer mode responsive to the answer mode determination is provided. Means for operating the telematics unit based on the initiated answer mode is also provided.

The aforementioned, and other features and advantages of the invention will become further apparent from the following detailed description of the presently preferred embodiments, read in conjunction with the accompanying drawings. The detailed description and drawings are merely illustrative of the invention rather than limiting, the scope of the invention being defined by the appended claims and equivalents thereof.

BRIEF DESCRIPTION OF THE DRAWINGS

FIG. 1 illustrates one embodiment of a system for implementing automated call routing using an origin identifier within a telematics equipped mobile vehicle, in accordance with one aspect of the current invention;

FIG. 2 is a flow diagram of one embodiment of a method of implementing automated call routing using an origin identifier within a telematics equipped mobile vehicle, in accordance with one aspect of the current invention; and

FIG. 3 is a flow diagram of another embodiment of a method of 10 implementing automated call routing using an origin identifier within a telematics equipped mobile vehicle, in accordance with one aspect of the current invention.

DETAILED DESCRIPTION OF THE DRAWINGS

FIG.1 illustrates one embodiment of system for data transmission over a 15 wireless communication system, in accordance with the present invention at **100**. Mobile vehicle communication system (**MVCS**) **100** includes a mobile vehicle communication unit (**MVCU**) **110**, a vehicle communication bus **112**, a telematics unit **120**, one or more wireless carrier systems **140**, one or more communication networks **142**, one or more land networks **144**, one or more client, personal or 20 user computers **150**, one or more web-hosting portals **160**, and one or more call centers **170**. In one embodiment, **MVCU 110** is implemented as a mobile vehicle equipped with suitable hardware and software for transmitting and receiving voice and data communications. **MVCS 100** may include additional components not relevant to the present discussion.

25 **MVCU 110** may also be referred to as a mobile vehicle throughout the discussion below. In operation, **MVCU 110** may be implemented as a motor vehicle, a marine vehicle, or as an aircraft. **MVCU 110** may include additional components not relevant to the present discussion.

MVCU 110, via a vehicle communication bus 112, sends signals to various units of equipment and systems (detailed below) within MVCU 110 to perform various functions such as unlocking a door, opening the trunk, setting personal comfort settings, and calling from telematics unit 120. In facilitating interactions among the various communication and electronic modules, vehicle communication bus 112 utilizes bus interfaces such as controller-area network (CAN), International Organization for Standardization (ISO) Standard 9141, J1850, ISO Standard 11898 for high-speed applications, ISO Standard 11519 for lower speed applications, and Society of Automotive Engineers (SAE) Standard J1850 for high speed and lower speed applications.

MVCU 110, via telematics unit 120, sends and receives radio transmissions from wireless carrier system 140. Wireless carrier system 140 is implemented as any suitable system for transmitting a signal from MVCU 110 to communication network 142.

Communication network 142 includes services from one or more mobile telephone switching offices and wireless networks. Communication network 142 connects wireless carrier system 140 to land network 144. Communication network 142 is implemented as any suitable system or collection of systems for connecting wireless carrier system 140 to MVCU 110 and land network 144.

Land network 144 connects communication network 142 to client computer 150, web-hosting portal 160, and call center 170. In one embodiment, land network 144 is a public-switched telephone network (PSTN). In another embodiment, land network 144 is implemented as an Internet protocol (IP) network. In other embodiments, land network 144 is implemented as a wired network, an optical network, a fiber network, other wireless networks, or any combination thereof. Land network 144 is connected to one or more landline telephones. Communication network 142 and land network 144 connect wireless carrier system 140 to web-hosting portal 160 and call center 170.

- Client, personal or user computer **150** includes a computer usable medium to execute Internet browser and Internet-access computer programs for sending and receiving data over land network **144** and optionally, wired or
- 5 wireless communication networks **142** to web-hosting portal **160**. Personal or client computer **150** sends user preferences to web-hosting portal through a web-page interface using communication standards such as hypertext transport protocol (HTTP), and transport-control protocol and Internet protocol (TCP/IP). In one embodiment, the data includes directives to change certain programming
- 10 and operational modes of electronic and mechanical systems within MVCU **110**. In operation, a client utilizes computer **150** to initiate setting or re-setting of user-preferences for MVCU **110**. User-preference data from client-side software is transmitted to server-side software of web-hosting portal **160**. User-preference data is stored at web-hosting portal **160**.
- 15 Web-hosting portal **160** includes one or more data modems **162**, one or more web servers **164**, one or more databases **166**, and a network **168**. Web-hosting portal **160** is connected directly by wire to call center **170**, or connected by phone lines to land network **144**, which is connected to call center **170**. In an example, web-hosting portal **160** is connected to call center **170** utilizing an IP
- 20 network. In this example, both components, web-hosting portal **160** and call center **170**, are connected land network **144** utilizing the IP network. In another example, web-hosting portal **160** is connected to land network **144** by one or more data modems **162**. Land network **144** sends digital data to and from modem **162**, data that is then transferred to web server **164**. Modem **162** may
- 25 reside inside web server **164**. Land network **144** transmits data communications between web-hosting portal **160** and call center **170**.

Web server **164** receives user-preference data from user computer **150** via land network **144**. In alternative embodiments, computer **150** includes a wireless modem to send data to web-hosting portal **160** through a wireless communication network **142** and a land network **144**. Data is received by land network **144** and sent to one or more web servers **164**. In one embodiment, web server **164** is implemented as any suitable hardware and software capable of providing web services to help change and transmit personal preference settings from a client at computer **150** to telematics unit **120** in MCVU **110**. Web server **164** sends to or receives from one or more databases **166** data transmissions via network **168**. Web server **164** includes computer applications and files for managing and storing personalization settings supplied by the client, such as door lock/unlock behavior, radio station present selections, climate controls, custom button configurations and theft alarm settings. For each client, the web server potentially stores hundreds of preferences for wireless vehicle communication, networking, maintenance and diagnostic services for a mobile vehicle.

In one embodiment, one or more web servers **164** are networked via network **168** to distribute user-preference data among its network components such as database **166**. In an example, database **166** is a part of or a separate computer from web server **164**. Web server **164** sends data transmissions with user preferences to call center **170** through land network **144**.

Call center **170** is a location where many calls are received and serviced at the same time, or where many calls are sent at the same time. In one embodiment, the call center is a telematics call center, facilitating communications to and from telematics unit **120** in MCVU **110**. In an example, the call center is a voice call center, providing verbal communications between an advisor in the call center and a subscriber in a mobile vehicle. In another example, the call center contains each of these functions. In other embodiments, call center **170** and web-hosting portal **160** are located in the same or different facilities.

Call center 170 contains one or more voice and data switches 172, one or more communication services managers 174, one or more communication services databases 176, one or more communication services advisors 178, and 5 one or more network 180.

Switch 172 of call center 170 connects to land network 144. Switch 172 transmits voice or data transmissions from call center 170, and receives voice or data transmissions from telematics unit 120 in MCVU 110 through wireless carrier system 140, communication network 142, and land network 144. Switch 10 172 receives data transmissions from and sends data transmissions to one or more web-hosting portals 160. Switch 172 receives data transmissions from or sends data transmissions to one or more communication services managers 174 via one or more network 180.

Communication services manager 174 is any suitable hardware and 15 software capable of providing requested communication services to telematics unit 120 in MCVU 110. Communication services manager 174 sends to or receives from one or more communication services databases 176 data transmissions via network system 180. Communication services manager 174 sends to or receives from one or more communication services advisors 178 20 data transmissions via network system 180. Communication services database 176 sends to or receives from communication services advisor 178 data transmissions via network system 180. Communication services advisor 178 receives from or sends to switch 172 voice or data transmissions.

Communication services manager 174 provides one or more of a variety 25 of services, including enrollment services, navigation assistance, directory assistance, roadside assistance, business or residential assistance, information services assistance, emergency assistance, and communications assistance. Communication services manager 174 receives service-preference requests for a variety of services from the client via computer 150, web-hosting portal 160, 30 and land network 144. Communication services manager 174 transmits user-

preference and other data to telematics unit **120** in MVCU **110** through wireless carrier system **140**, communication network **142**, land network **144**, voice and data switch **172**, and network system **180**. Communication services manager **174** stores or retrieves data and information from communication services database **176**. Communication services manager **174** may provide requested information to communication services advisor **178**.

In one embodiment, communication services advisor **178** is implemented as a real advisor. In an example, a real advisor is a human being in verbal communication with a user or subscriber (e.g. a client) in MVCU **110** via telematics unit **120**. In another embodiment, communication services advisor **178** is implemented as a virtual advisor. In an example, a virtual advisor is implemented as a synthesized voice interface responding to requests from telematics unit **120** in MVCU **110**.

Communication services advisor **178** provides services to telematics unit **120** in MVCU **110**. Services provided by communication services advisor **178** include enrollment services, navigation assistance, real-time traffic advisories, directory assistance, roadside assistance, business or residential assistance, information services assistance, emergency assistance, and communications assistance. Communication services advisor **178** communicate with telematics unit **120** in MVCU **110** through wireless carrier system **140**, communication network **142**, and land network **144** using voice transmissions, or through communication services manager **174** and switch **172** using data transmissions. Switch **172** selects between voice transmissions and data transmissions.

Telematics unit 120 includes a digital signal processor (DSP) 122 connected to a wireless modem 124, a global positioning system (GPS) unit 126, an in-vehicle memory 128, a microphone 130, one or more speakers 132, origin identifier module 134, and an embedded or in-vehicle mobile phone 136. In other embodiments, telematics unit 120 may be implemented without one or more of the above listed components, such as, for example GPS unit 126 and speakers 132. DSP 122 further includes vehicle information controller 123. Telematics unit 120 may include additional components not relevant to the present discussion.

In one embodiment, DSP 122 is implemented as a microcontroller, controller, host processor, or vehicle communications processor. In an example, DSP 122 is implemented as an application specific integrated circuit (ASIC). Vehicle information controller 123 is a software module that facilitates the reception and implementation of commands from a MVCS 100 controller, such as, for example call center 170. In an example, commands from call center 170 include vehicle-side system updates. In another example, commands from call center 170 include user preference updates. In another embodiment, vehicle information controller 123 is implemented as a hardware module (not shown), in communication with DSP 122, including software that facilitates the reception and implementation of commands from call center 170. GPS unit 126 provides longitude and latitude coordinates of the vehicle responsive to a GPS broadcast signal received from a one or more GPS satellite broadcast systems (not shown). In-vehicle mobile phone 136 is a cellular-type phone, such as, for example an analog, digital, dual-mode, dual-band, multi-mode or multi-band cellular phone.

DSP **122** executes various computer programs that control programming and operational modes of electronic and mechanical systems within MVCU **110**. DSP **122** controls communications (e.g. call signals) between telematics unit **120**, wireless carrier system **140**, and call center **170**. In one embodiment, a voice-recognition application is installed in DSP **122** that can translate human voice input through microphone **130** to digital signals. DSP **122** generates and accepts digital signals transmitted between telematics unit **120** and a vehicle communication bus **112** that is connected to various electronic modules in the vehicle. In one embodiment, these digital signals activate the programming mode and operation modes, as well as provide for data transfers. In this embodiment, signals from DSP **122** are translated into voice messages and sent out through speaker **132**.

Origin identifier module **134** includes hardware and software to detect and identify origin identifiers included within communications between telematics unit **120**, wireless carrier system **140**, and call center **170**. Examples of origin identifiers include automatic number identifiers and digital signatures. Digital signature is a form of cryptography that appends extra data to a message that identifies and authenticates the sender and message data using public or private encryption key methods. Encryption key methods are well known to practitioners in the art. In one embodiment, origin identifier module **134** is implemented as an independent hardware component and associated software that is interfaced with DSP **122**. In another embodiment, origin identifier module **134** is implemented as a hardware component and associated software that is embedded within DSP **122**.

- The origin identifier included within the communication is sent to DSP 122 for processing. DSP 122 determines and initiates one of several answer modes responsive to the received origin identifier. Each answer mode is associated with 5 predetermined group of origin identifiers. In one embodiment, the answer modes are associated with a predetermined group of origin identifiers provided by a MVCS 100 controller, such as, for example call center 170. The predetermined group of origin identifiers is stored within DSP 122, such as, for example in a look-up table within DSP 122 or within a component of DSP 122. In another 10 embodiment, one or more of the answer modes is associated with one or more predetermined groups of origin identifiers provided within user-preference data. In an example, one or more of the answer modes is associated with one or more predetermined groups of origin identifiers provided by a client via computer 150 and call center 170 and stored within DSP 122.
- 15 In operation, each answer mode provides operating parameters for directing an incoming call signal. In one embodiment, two answer modes are provided by a mobile vehicle communication system controller. The first answer mode is associated with a predetermined group of origin identifiers that are compared to the origin identifier within the incoming call signal. If the origin 20 identifier within the incoming call signal matches any of the predetermined group of origin identifiers, the first answer mode is initiated. In this embodiment, when the first answer mode is initiated the incoming call signal is directed and connected to vehicle information controller 123 located within telematics unit 120, such as, for example within DSP 122. Connecting the incoming call to vehicle 25 information controller 123 allows reception and implementation of commands from call center 170, such as, for example vehicle updates.

In this embodiment, the second answer mode is associated with all remaining origin identifiers. If the origin identifier within the incoming call signal does not match any of the predetermined group of origin identifiers, the second 5 answer mode is initiated. In this embodiment, when the second answer mode is initiated, the incoming call signal is directed to a user interface. In an example, if the origin identifier in the incoming call signal does not match any of the predetermined group of origin identifiers, the incoming call signal is directed to a user interface within the mobile vehicle, such as, in-vehicle mobile phone 136. In 10 this embodiment, the incoming call signal is connected to the user interface if a user activates the user interface. Alternatively, if the user interface is not activated, the incoming call signal is directed to an electronic voice-mail system. In an example, if the user interface is not activated, the incoming call signal is directed to an electronic voice-mail system by an associated phone service 15 provider.

In other embodiments, additional origin identifiers are provided as well as associated answer modes, such as, for example by the client. In these embodiments, each answer mode provides additional operating parameters for directing the incoming call signal(s). In an example, a client provides additional 20 answer modes and associated origin identifiers to telematics unit 120 via computer 150 and call center 170. In this example, a client provides one or more origin identifiers and associates one or more answer modes to the origin identifiers, such as, providing a list of origin identifiers that the client desires to be sent directly to the electronic voice-mail system by an associated phone service 25 provider. The additional answer modes provide greater flexibility to the client as well as the system provider.

- FIG. 2** is a flow diagram of an embodiment of a method of implementing automated call routing using an origin identifier within a telematics equipped mobile vehicle. In **FIG. 2**, method **200** may utilize one or more systems detailed in **FIG. 1** above. The present invention can also take the form of a computer usable medium including a program for configuring an electronic module within a vehicle. The program stored in the computer usable medium includes computer program code for executing the method steps described in **FIG. 2**. In **FIG. 2**, method **200** begins at step **210**.
- 5 At step **220**, an incoming call signal, including an origin identifier, is received at a telematics unit within a mobile vehicle. Examples of origin identifiers include an automatic number identifier, a digital signature. In an example and referring to **FIG. 1** above, an incoming call signal, including an origin identifier, in mobile vehicle communication system (MVCS) **100** is received at DSP **122** within mobile vehicle communication unit (MVCU) **110**.
- 10 At step **230**, an answer mode is determined based on the origin identifier of the incoming call signal. In one embodiment, determining the answer mode includes determining a first answer mode when the origin identifier is within a predetermined group of origin identifiers and determining a second answer mode when the origin identifier is not within the predetermined group of origin identifiers. In an example and referring to **FIG. 1** above, the incoming call signal is routed to origin identifier module **134** that detects and identifies an origin identifier included within the incoming signal. The detected origin identifier is then sent to DSP **122** for processing. DSP **122** processes the origin identifier and determines if the origin identifier is included within a predetermined group of origin identifiers associated with the first answer mode. If the origin identifier is not included within a predetermined group of origin identifiers associated with the first answer mode, then DSP **122** determines the second answer mode is the answer mode.
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In other embodiments, additional answer modes are provided as well as associated predetermined groups of origin identifiers. In these embodiments, each answer mode provides additional operating parameters for directing the 5 incoming call signal(s) as described in **FIG. 1**, above.

At step **240**, the determined answer mode is initiated. In one embodiment, the first answer mode is initiated when DSP **122** determines that the origin identifier is within a predetermined group of origin identifiers. In this embodiment, the second answer mode is initiated when DSP **122** determines that the origin 10 identifier is not within a predetermined group of origin identifiers.

At step **250**, the telematics unit operates based on the initiated answer mode. In one embodiment, operating the telematics unit based on the first answer mode includes directing the incoming call signal to a vehicle information controller within the telematics unit. In this embodiment, operating the telematics 15 unit based on the first answer mode additionally includes connecting the incoming call signal to the vehicle information controller within the telematics unit. In an example and referring to **FIG. 1** above, operating telematics unit **120** based on the first answer mode includes directing and connecting the incoming call signal to a vehicle information controller **123** within telematics unit **120**.

20 In another embodiment, operating the telematics unit based on the second answer mode includes directing the incoming call signal to a user interface within the telematics unit. In this embodiment, operating the telematics unit based on the second answer mode additionally includes connecting the incoming call signal to the user interface within the telematics unit responsive to a user 25 interface activation. In an example and referring to **FIG. 1** above, operating telematics unit **120** based on the second answer mode includes directing and connecting the incoming call signal to a user interface, such as, in-vehicle mobile phone **136** within telematics unit **120** responsive to a user interface activation.

In yet another embodiment, operating the telematics unit based on the second answer mode includes directing the incoming call signal to a user interface within the telematics unit. In this embodiment, operating the telematics unit based on the second answer mode additionally includes determining the user interface is not activated and activating an electronic voice-mail system. In an example, operating the telematics unit based on the second answer mode includes determining the user interface, such as, in-vehicle mobile phone 136 is not activated and activating an electronic voicemail system as described in FIG. 1, above.

At step 260, the method ends.

FIG. 3 is a flow diagram of another embodiment of a method of implementing automated call routing using an origin identifier within a telematics equipped mobile vehicle. In **FIG. 3**, method 300 may utilize one or more systems detailed in **FIG. 1** above. The present invention can also take the form of a computer usable medium including a program for configuring an electronic module within a vehicle. The program stored in the computer usable medium includes computer program code for executing the method steps described in **FIG. 3**. In **FIG. 3**, method 300 begins at step 310.

At decision step 320, a determination is made as to if an origin identifier, such as, for example an automatic number identifier (ANI) is included within an incoming call signal. If there is an origin identifier within the incoming call signal, method 300 advances to step 360. If there is not an origin identifier within the incoming call signal, method 300 advances to step 325.

At decision step 360, a determination is made as to if the origin identifier is within a call center identified range of origin identifiers. If the origin identifier is within the call center identified range of origin identifiers, method 300 advances to step 325. If the origin identifier is not within the call center identified range of origin identifiers, method 300 advances to step 365.

At step 325, the mobile vehicle communication unit (MVCU) automatically answers the incoming call signal. At decision step 330, a determination is made as to if a modem is present or functioning, such as, for example if "modem tones" 5 are present. If the modem is present and functioning, method 300 advances to step 340. If the modem is not present or is not functioning, or is present and functioning but not producing "modem tones," method 300 advances to step 350.

At step 340, the telematics unit within the MVCU enters a data mode, such as, for example to receive data from the call center. At step 350, the telematics 10 unit within the MVCU enters a voice mode such as, for example to receive a voice transmission from the call center.

At step 365, the telematics unit directs and connects the incoming call signal to a vehicle information controller that initiates ring tones within the mobile vehicle. At decision step 370, a determination is made as to if the incoming call 15 signal is answered within a preset amount of time, such as, for example within a determined amount of rings. If the incoming call signal is answered within a preset amount of time, method 300 advances to step 380. If the incoming call signal is not answered within a preset amount of time, method 300 advances to step 390.

20 At step 380, the incoming call signal is connected to a user interface for execution. At step 380, the incoming call signal is forwarded to an electronic voicemail system. In another embodiment, the incoming call signal is routed to an electronic voicemail system by the call signal provider for voicemail execution.

The above-described methods and implementation for implementing 25 automated call routing using an origin identifier within a telematics equipped mobile vehicle are example methods and implementations. These methods and implementations illustrate one possible approach for implementing automated call routing using an origin identifier within a telematics equipped mobile vehicle. The actual implementation may vary from the method discussed. Moreover,

various other improvements and modifications to this invention may occur to those skilled in the art, and those improvements and modifications will fall within the scope of this invention as set forth in the claims below.

- 5 The present invention may be embodied in other specific forms without departing from its spirit or essential characteristics. The described embodiments are to be considered in all respects only as illustrative and not restrictive.